

Part 1 General

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.
- .2 Provide fully tested and operational mechanical systems in complete accordance with applicable codes and bylaws.
- .3 Contract documents of this section are diagrammatic and approximately to scale. Do not scale from the drawings, exact dimensions to be taken from architectural drawings or from the Site. The drawings and specifications establish scope for material and installation quality and are **not** detailed installation instructions. Follow Manufacturer's recommendations for installation supplemented by contract documents, unless otherwise specified by the Contract Administrator. Any discrepancies must be brought to the Contract Administrator's attention in writing prior to the close of the Bid Opportunity.

1.2 SCOPE OF WORK

- .1 Work to include labour, material and equipment required for supplying, installing, testing, adjusting, balancing, commissioning mechanical systems and provision of As-built drawings, O & M manuals and personnel training as detailed in this and other Sections of Divisions 21, 22 & 23.
- .2 It is the responsibility of the Contractor to co-ordinate the work among the various sub-trades to ensure complete functioning systems.

1.3 DEFINITIONS

- .1 Whenever "drawings" and "specifications" are referred to, it means "the Contract Documents".

1.4 WORK INCLUDED

- .1 Sections of these mechanical specifications are not intended to delegate functions or to delegate work and supply to any specific trade. The work shall include all labour, materials, equipment, and tools required for a complete and working installation as described on the drawings and all Sections of Divisions 21, 22 & 23.

1.5 COMMISSIONING

- .1 Systems commissioning will be conducted prior to substantial completion. The purpose of the Commissioning is to ensure all systems are functioning as designed prior to substantial completion.
- .2 Commissioning will require the presence of knowledgeable representatives of the necessary Mechanical Trades. The Contractor shall include all necessary costs for systems commissioning. The Contract Administrator will participate to the extent deemed necessary.
- .3 All aspects of mechanical systems operations will be operated, checked and verified. If any portion of the work fails to meet design requirements, the Commissioning procedure will be

halted and only resumed when all necessary repairs are completed. All extra costs including costs for the Contract Administrator to revisit the Site resulting from this postponement will be borne by this Contractor.

.4 The Contractor shall submit, to the Contract Administrator, a commissioning report detailing the commissioning tests performed and the results of these tests. Format of report is to be one sheet for each piece of mechanical equipment and it shall include: Equipment tag, description, location and point form description of tests and results. Submit blank draft commissioning test forms for each equipment to Contract Administrator for review prior to testing.

.5 Contractor to provide seasonal commissioning as required. If heating systems can not be commissioned at the completion of the work due to outside weather conditions, the Contractor is to return for the heating season to ensure the system is fully operational and functioning properly.

1.6 COMPLETION

.1 After completing tests and adjustments remove temporary covers, and strainers, and obstructions to flow. Drain, flush and refill piping systems as often as required until all piping is clear of dirt and debris.

.2 Leave Mechanical work in specified working order.

.3 Provide spare components as specified in other Sections of Divisions 21, 22 & 23.

.4 Provide one set of all specialized tools required to service equipment as recommended by manufacturers.

1.7 CONTRACT DRAWINGS AND SPECIFICATIONS

.1 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both. Many items, such as valves, vents, thermometers, pressure gauges, etc. are shown only on schematics and are not shown on plan and elevation views. Provide and install all items shown in any or all of the drawings (or schematics).

.2 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.

.3 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and should not be used as an excuse for deficiencies or omissions.

.4 Follow the recommended installation details and procedures for equipment as found in Supplier technical data, supplemented by contract document details.

.5 Install piping, ductwork, etc., generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space. Remove piping, ductwork, etc. that is not properly installed and replace to the satisfaction of the Contract Administrator at no additional cost.

- .6 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.
- .7 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use of space through which they pass, while allowing adequate space for service, maintenance, repair, or replacement for all equipment.
- .8 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. Basically, work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.
- .9 All individual pieces of equipment shall be provided with appropriate means of isolation and bypass so that systems may continue to operate during maintenance of individual components. It is understood that this may not be possible in all situations, but this is a requirement where isolation is possible.
- .10 Drawings and specifications to be considered as an integral part of contract documents and neither drawings nor specifications are to be used alone. Misinterpretation of requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to approval of Contract Administrator.
- .11 Obtain information involving accurate dimensions from dimensions shown by Site measurement. Visit and inspect the Site of the work to verify location and elevation of existing services which may affect the Bid and work of this Division (water, electrical, sanitary, ductwork etc.) before submission of Bid and proceeding with work. Make all necessary changes or additions to runs to accommodate structural conditions (pipes or ducts around beams, columns etc.) without additional expense to the Contract Administrator. Locations of pipes, ducts and other equipment to be altered without charge to Contract Administrator, provided change is made before installation and does not necessitate additional materials and that all such changes are acceptable to the Contract Administrator and are suitably recorded on Record Set of Drawings.
- .12 Confirm on the Site the exact location and mounting elevation of outlets and fixtures as related to existing Mechanical & Electrical components.
- .13 As work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for appropriate action before proceeding. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.
- .14 Alter, at no additional cost, the locations of materials and/or equipment as directed that do not necessitate additional material.

1.8 CUTTING AND PATCHING

- .1 Cutting, core drilling, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping to be included in the Work.
- .2 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening, the opening size will be the minimum required, and that patching will be the responsibility of the trade making the opening to the original or specified conditions.
- .3 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.

1.9 PAINTING

- .1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and Site fabricated work.
- .2 Prime and paint marred finished paintwork to match original.
- .3 Restore to new condition finishes which have been damaged too extensively to be merely primed and touched up.
- .4 All new exposed ductwork, canvas-wrapped and un-insulated piping to be painted. Refer to Section 23 05 54, item 2.5.7.2 for general colour legend. Confirm final colours with Contract Administrator.

1.10 DOCUMENTATION AND SYSTEMS ACCEPTANCE

- .1 Provide the following on Substantial Performance of the work:
 - .1 As-Built drawings. As-built information is to be recorded as detailed elsewhere in this Section. Submit As-Built drawings to Contract Administrator for review prior to Total Performance.
 - .2 Contractor shall assemble the specified quantity of O&M manuals in D-ring binders with index tabs, each containing this Sub-Contractor's and suppliers names and telephone numbers, data sheets, valve charts, brochures, operating, maintenance, and lubricating instructions as well as number coded wiring diagrams and a complete set of reviewed shop drawings for all equipment provided by this Division. Present all copies to the Contract Administrator for review.
 - .3 Warranty certificate per Division 21 and extended warranty certificates, where specified in other Sections of Divisions 21, 22 & 23.
 - .4 Air and water balancing report. The work of Divisions 21, 22 & 23 will not be considered totally performed until acceptance by the Contract Administrator of the Air and Water Balancing Report.

1.11 EQUIPMENT PROTECTION AND CLEANUP

- .1 Protect equipment and materials in storage on Site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

- .2 Clean exposed surfaces of mechanical equipment, ductwork, piping, etc., and polish plated work.
- .3 Remove tools, surplus and waste material from the building Site upon completion. Clean grease, dirt and excess material from walls, floors, ceilings and fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.

1.12 EXAMINATION OF THE SITE AND DOCUMENTATION

- .1 Prior to submitting Bid, carefully examine Site conditions, adjacent buildings and local conditions at the Site, which could affect the work of this Division.
- .2 Examine all contract drawings to ensure work can be performed without changes to the building, or work, as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences has been brought to Contract Administrator's attention, in writing, prior to closing of the Bid Opportunity.
- .3 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation thereof in locations shown on the drawings.

1.13 GUARANTEES AND WARRANTIES

- .1 Warranty shall be as per D21 Warranty.

1.14 INSTRUCTIONS TO THE CONTRACT ADMINISTRATOR

- .1 At the completion of the work, the Contractor shall instruct and demonstrate to the Contract Administrator's employee(s), or Contract Administrator's representative, who will have charge of the equipment, the operation, maintenance care, and adjustment of all parts of the system to satisfaction of Contract Administrator.
- .2 Demonstrate the specific starting, stopping, controlling and general maintenance requirements for each major piece of equipment and system.
- .3 Demonstrate all mechanical systems and provide a Contractor guided tour of the facility to point out all locations of equipment, dampers, control devices and the like.

1.15 LIABILITIES

- .1 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to Contract Administrator.
- .2 Co-ordinate work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all contract drawings.

1.16 OPERATING AND MAINTENANCE MANUALS

- .1 Provide O & M Manuals to the Contract Administrator for review 1 weeks prior to final inspection. Incorporate Contract Administrator's review comments into final copies.

- .2 Provide three (3) sets of manuals in separate 3 "D" ring, loose leaf binders with spine and face pockets, with the project name clearly indicated on the spine and face. The final accepted copies shall be provided to the Contract Administrator.
- .3 General catalogue data for the Operations and Maintenance Manual is unacceptable. If manufacturer's specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g., manufacturer's model number, project equipment designation) is to be noted on Manufacturer's specification sheet which includes all details for this unit, including complete model number, serial number, and construction & performance data.
- .4 The outline for the Operating & Maintenance Manual shall be as follows:
 - Contractor and Subcontractor Contact Information
 - Operating Instructions
 - Seasonal Operations
 - Normal Valve Positions and Control
 - Recommended Inspection and Preventative Maintenance
 - Maintenance Schedule
 - Description of Maintenance Procedures
 - Recommended Major Equipment Spare Parts List
 - Appendices
 - Equipment Shop Drawings
 - Equipment Supplier Schedule
 - Manufacturer Recommended O & M Information
 - Exploded Views and Parts Lists
 - As-Built Drawings (reduced)
 - Control Narrative
 - Control Drawings
- .5 The Contractor shall organize the O & M manual with tabs for easy reference to equipment, reports and operational material. Each main piece of equipment is to be a separate tab and all related O & M material shall be tabbed separately under each piece of equipment.**
- .6 Include the following information in the manuals, incorporated into the outline format above, as applicable:
 - .1 Mechanical Systems
 1. Maintenance Tasks - including daily, weekly, monthly, semi-annual and annual checks.
 2. Lubrication Information.
 3. List of Contractors and Equipment Suppliers including contact information
 4. Parts and Troubleshooting Information.
 - .2 Certification and Identification
 1. Inspection Certificates
 2. Balance Reports
 - .3 Component Information

- .1 Section for each type of equipment to include shop drawings, installation and maintenance information.
- .4 Safety Information
- .5 Also provide the following information:
 - .1 Include control diagrams, (including Building Automation System diagrams), sequence of operations, and service instructions (calibration, trouble shooting, etc.).
 - .2 Provide Manufacturer's preventive maintenance procedures (recommended lubrication materials and procedures, frequency, etc.).
 - .3 System and equipment troubleshooting guides.
 - .4 A copy of the final balancing reports.

1.17 PERFORMANCE OF WORK

- .1 Protect and maintain work until work has been completed and accepted. Protect work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of work, without expense to the Contract Administrator.

1.18 PERMITS, FEES AND INSPECTIONS

- .1 Apply for, obtain, and pay for all permits, licences, inspections, examinations and fees required for work of Divisions 21, 22 & 23.
- .2 Review drawings with authorities having jurisdiction to ensure compliance with all applicable codes and by-laws.
- .3 In case of conflict, codes and regulations take precedence over the contract documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein. Any discrepancies must be brought to the Contract Administrator's attention in writing.
- .4 Before starting any work submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Contract Administrator immediately of such changes. Prepare and submit any additional drawings, details or information as may be required.

1.19 RECORD DRAWINGS

- .1 Obtain one set of drawings and specifications and, as the job progresses, mark these prints clearly in red pencil to accurately indicate installed work, as well as alterations to ductwork, piping, equipment and associated work changes and deviations from work shown on Contract Drawings, including all Addenda and Work Order Changes.
- .2 As-Built drawings to be maintained on a continuous basis to ensure they are up-to-date and accurate, and have current prints available for inspection at the Site at all times.
- .3 Submit this set of record drawings to the Contract Administrator for review on completion of the work. Should the record drawings be lacking information or details of changes made, they will

be returned to the Contractor. The Contractor is to, without additional cost to the Contract Administrator, make the required Site inspections, etc. and update the record drawings to the satisfaction of the Contract Administrator.

- .4 Contractor to submit to the Contract Administrator at substantial completion:
 - i. One hand mark-up set of drawings
 - ii. One AutoCAD as-built file on CD (can be submitted at project completion)
 - iii. Two full size as-built prints from the AutoCAD file (can be submitted at project completion)

1.20 REGULATORY REQUIREMENTS

- .1 Comply with the most stringent requirements of all Municipal, Provincial and Federal Bylaws and Ordinances, the requirements of Utilities such as Manitoba Hydro, and all sections of this specification.
- .2 Provide necessary notices, obtain permits and pay all fees, in order that work specified may be carried out.
- .3 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

1.21 SHOP DRAWINGS

- .1 Submit to the Contract Administrator for review a maximum of four (4) sets of detailed shop drawings. Electronic .pdf format shop drawings are acceptable.
- .2 Check shop drawings for conformity to plans and specifications prior to submission.
- .3 Submit shop drawings for all items specified in the sections of Divisions 21, 22 & 23. For equipment, provide performance, physical and operating data as described in the Specifications and listed in equipment schedules. Provide performance curves for all pumps and fans.
- .4 Shop drawings shall include copies of applicable brochure or catalogue material clearly indicating manufacturer and model. Ambiguous shop drawings will not be reviewed.
- .5 Clearly mark submittal to indicate all differences from the specified material. The Contract Administrator will require all options and material indicated on the shop drawing to be provided and installed. Specifically note on the submittal specified features such as tank linings, pump seal materials, painting finish, etc.
- .6 Include dimensional and technical data sufficient to determine if equipment meets requirements, including weights, loading points, electrical data and motor sizes.
- .7 Identify the equipment by system name and number, e.g. " S1, Second Floor, Air Supply Fan", "P1, Chilled Water Pump", etc.
- .8 Installed materials and equipment shall meet specified requirements regardless of whether or not the shop drawings were reviewed by the Contract Administrator.

- .9 Each drawing to include name of project, equipment supplier and clause number equipment is specified under.
- .10 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.
- .11 Take full responsibility for securing and verifying field dimensions. In cases where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be worked to and ensure that other sub-trades are aware of these dimensions and shall comply with them.
- .12 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such errors of interferences, but Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or interferences, or from necessity of furnishing such work, and materials as may be required for completion of work as called for in contract documents.
- .13 This review by the Contract Administrator is for the sole purpose of ascertaining conformance with the design concept.
- .14 Do not order equipment until the Contract Administrator has reviewed and returned the reviewed shop drawings.
- .15 Keep one set of shop drawings on the Site.
- .16 Bind one complete set of checked shop drawings in each operating and maintenance instruction manual.

1.22 SITE REVIEW

- .1 The Contractor's work will be reviewed periodically by the Contract Administrator or their representatives, solely for the purpose of determining general quality of work. Guidance will be offered to Contractor in interpretation of plans and specifications as assistance to carry out work.
- .2 Reviews and directives given to Contractor, his agents, servants and employees does not relieve the Contractor, his agents, servants or employees of their responsibility to provide the work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose the Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.

1.23 SPECIAL TOOLS AND SPARE PARTS

- .1 Furnish the Contract Administrator with spare parts as follows:
 - .1 Spare parts as detailed in individual Sections of Divisions 21, 22 & 23.

1.24 STANDARDS

- .1 Conform to the best modern practices of workmanship and installation methods and employ only skilled tradesmen working under the direction of fully qualified personnel.

1.25 STANDARD OF MATERIAL

- .1 All materials and equipment installed under this contract shall be new unless otherwise noted.
- .2 Materials and equipment specified and acceptable manufacturers are named in this specification for the purpose of establishing the standard of materials and workmanship to which Contractor shall adhere. Bid price shall be based on the use of materials and equipment as specified.
- .3 Provide new material and equipment of first class quality, delivered, erected, connected and finished in every detail, and supplied with the acceptance of the Contract Administrator. Assume responsibility of ensuring that provided equipment performs as specified.
- .4 In the preparation of the Bid, if the Contractor neglects to name the manufacturer where accepted equals have been shown, it will be understood that the specified equipment will be provided.

1.26 SUBSTANTIAL COMPLETION

- .1 Prior to requesting any substantial completion inspection, complete all of the following items.
 - .1 All systems shall be operational with alarms, interlocks and control functions.
 - .2 Obtain all certificates of approval from the authorities having jurisdiction.
 - .3 All manufacturer start-ups shall be complete.
 - .4 Complete valve tagging and identification of all new mechanical systems and components.
 - .5 Lubricate all equipment as per manufacturers' instructions.
 - .6 Submit O & M Manuals and perform operator training.
 - .7 Provide all Manufacturers' reports required by specifications.
 - .8 Complete System Commissioning
 - .9 Complete all previously identified deficiencies.
 - .10 Clean equipment both inside and out.
 - .11 Complete final air and water balancing and submit reports.
 - .12 Complete final calibration.
 - .13 Provide As-Built record drawings in accordance with the Bid Opportunity documents.

1.27 SUPERINTENDENCE

- .1 Maintain qualified job site personnel consisting of licensed tradesmen and registered apprentices with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

1.28 TEMPORARY USE OF EQUIPMENT

- .1 Permanent systems and/or equipment not to be used during construction period, without the Contract Administrator's permission.

- .2 Temporary use of equipment shall in no way relieve Contractor of providing warranties, as described elsewhere in this Section and in Division 1, on all equipment and systems so used.
- .3 Operate systems under conditions that ensure no temporary or permanent damage. Operate systems with proper treatment. Operate fans at proper resistance with filters installed. Change filters at regular intervals and prior to final acceptance. Operate with proper safety devices and controls installed and fully operational.
- .4 Under no circumstances shall air handling units, heat recovery ventilators or other air systems be used to provide temporary heating, cooling or ventilation during construction. Air systems (air handling units and heat recovery ventilators) shall only be operated after all drywall sanding and carpet installation (or any other operation that creates considerable dust or fibres) is complete.

1.29 WELDING REGULATIONS

- .1 Welding shall be performed by welder holding current welder's certificate from Provincial Department of Labour.
- .2 Suitable fire extinguishers are to be present during welding operations and during fire watch period.
- .3 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets.
- .4 Maintain a fire watch for a minimum of 1 hour after welding operations are complete.
- .5 Contractor to submit Hot Work Permit to the Contract Administrator a minimum of two business days prior to performing the work.

1.30 WORKMANSHIP

- .1 Only first class workmanship will be accepted, not only as regards to safety, efficiency, and durability but also as regards to neatness of detail. Pipework must be installed parallel to, or at right angles to building planes. The entire work shall present a neat and clean appearance on completion.

Part 2 Products

- .1 NOT USED.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers.

3.3 DEMONSTRATION

- .1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manuals and as-built drawings as part of instruction materials.

END OF SECTION